total birds (males and females) counted in flying flocks	13,529
total white-plumaged birds in sitting flocks	190,132
total white-plumaged birds counted in 13 selected sex ratio slides	13,084
total birds counted in 13 selected sex ratio slides	24,051
total birds per male in 13 sex ratio slides	1.838199
lower 95% CI for sex ratio (total birds per male)	1.683028
upper 95% CI for sex ratio (total birds per male)	1.99337
total birds (190,132*1.838199)+13,529	363,030
lower 95% CI (190,132*1.683028)+13,529	333,526
upper 95% CI (190,132*1.99337)+13,529	392,532

The size of this estimate in the context of our limited knowledge of breeding populations from recent surveys in Alaska and Siberia strongly suggests that most if not all of the world's population of this species regularly spends at least part of late winter together in this general area in the northern Bering Sea. Another anecdote that supports this area as a traditional favored winter habitat is the sighting of "a large number of large flocks of eiders" during a bowhead whale census conducted during March and April, 1979 (Brueggeman pers. comm.). The sightings, made from a shipboard helicopter, were made in precisely the area where we encountered the wintering spectacled eiders in 1996 and 1997. This was the only location where the investigators encountered large eider flocks. The observers were not able to positively identify the eiders to species due to the survey altitude and other priorities, but we feel it is highly likely that they were mostly or totally spectacled eiders. We also suggest that the distribution of spectacled eiders observed in 1995, 120 km southeast of the 1996 and 1997 locations, may have resulted from some or a major portion of the wintering population being displaced from their preferred winter habitat by extraordinarily severe sea ice conditions.

Individual flocks observed during the 1997 survey ranged from 800 to 150,966 birds, and the latter flock occupied 8 km of a long, narrow open lead. Many of the flocks were loafing on the ice surrounding small pools of open water that had little or no openings to the water below. The flocks flew freely between these ponds and the open holes and leads. We observed no birds obviously diving to feed during this or any of the earlier late winter surveys. This may have been due to our presence, or perhaps they prefer to feed at a different time of day. We suspect the latter because a high percentage of the flocks seemed to be settled on loafing areas without nearby diving access.

During the BBC helicopter flight we noticed that the eiders tolerated close passes (as close as 150 meters) without taking flight and showing only mild alarm and avoidance behavior (e.g. moving away a few steps). On the other hand, occasional approaches within 150 to 200 meters for photos during the fixed wing survey often elicited departure of the entire flock to another lead.

We observed no waterbird species other than spectacled eiders in 1997, primarily because we did not search the polynya adjacent to St. Lawrence Island where oldsquaw, common and king eiders are typically found. During the flight from the survey area to Gambell, as we traversed open water adjacent to the west side of the island, we observed oldsquaw, common and king eiders, but, due to fuel reserve concerns, we did not attempt counts.

RECOMMENDATIONS

We feel that the 1997 late winter spectacled eider survey reinforces our hypothesis that essentially the entire world's population of this species winters together in a predictable location in the Bering Sea. This knowledge puts us as resource managers in the enviable position of being able to periodically monitor, with a high degree of precision, the worldwide population of a species that is of interest, concern, and possibly a good indicator of large scale changes in the Bering Sea ecosystem. While the current immediate concern is focused on the Yukon-Kuskokwim Delta and the Alaska arctic slope breeding populations, which have been shown to be genetically distinct, worldwide concern for declines in boreal sea duck populations should demonstrate the prudence of capitalizing on such opportunities for obtaining precise population estimates and trend data. We recommend attempting this survey at least every second year, recognizing that conditions will not permit a successful mission for every attempt. We also recommend supporting additional studies of the wintering ecology of this species, which would help place our trend data in context. For instance, having set foot on the sea ice near the wintering birds this year, I believe that with careful planning and local logistic support it may be safe and feasible for a small research team to spend some fruitful time on the ice collecting food habits and behavioral data.

ACKNOWLEDGMENTS

Special thanks go to William Eldridge for his excellent job as observer under challenging conditions in 1996. Robert Stehn adapted the statistical methods and performed the analysis that enabled us to estimate the precision of our results. Margaret Petersen and David Douglas provided satellite telemetry data critical to planning the surveys. Dennis Marks spent many tedious hours counting birds in photographs. Our sincere thanks go to Winnie James and other people of Gambell who assisted with logistics for the helicopter flight. The Yukon Delta National Wildlife Refuge provided the use of their cabin and other equipment, and the able assistance of refuge employee Henry Ivanoff, all of which made operation out of Mekoryuk practical and enjoyable in 1995 and 1996. We would also like to thank members of the Spectacled Eider Recovery Team for their continued support of this and other aerial survey investigations.

LITERATURE CITED

Anthony, R. M. and R. A. Stehn. 1994. Navigating aerial transects with a laptop computer. Wildl. Soc. Bull. 22:125-129.

Cochran, W. G. 1963. Sampling techniques. Second ed. John Wiley and Sons, Inc., New York, N.Y. 413 pp.

Dau, C. P., and S. A. Kistchinski. 1977. Seasonal movements and distribution of the spectacled eider. Wildfowl 28:65-75.

Larned, W. and B. McCaffery. 1993. Norton Sound eider survey, August 30-31, 1993. Unpublished trip report. U.S. Fish and Wildlife Service. Anchorage, Alaska. 8pp.

Larned, W., G. R. Balogh, and M. R. Petersen. 1995a. Distribution and abundance of spectacled eiders (*Somateria fischeri*) in Ledyard Bay, Alaska, September 1995.

Larned, W., G. R. Balogh, and M. R. Petersen. 1995b. Late winter distribution of spectacled eiders (*Somateria fischeri*) in the Bering Sea, 1995. Unpublished report. U.S. Fish and Wildlife Service. Anchorage, Alaska. 22 pp.

Larned, W., J. I. Hodges and M. R. Petersen. 1995c. Distribution and abundance of spectacled eiders (*Somateria fischeri*) in Mechigmenskiya Bay, Chukotka, Russia, September 1995. Unpublished report. U.S. Fish and Wildlife Service. Anchorage, Alaska. 11 pp.

Larned, W., M. R. Petersen, K. Laing, R. Platte, and J. I. Hodges. 1995d. Location and Characteristics of spectacled eider molting and wintering areas, 1993-94. Unpublished progress report. U.S. Fish and Wildlife Service. Anchorage, Alaska. 23pp.

Petersen, M. R., D. C. Douglas, and D. M. Mulcahy. 1995. Use of implanted satellite transmitters to locate spectacled eiders at-sea. Condor 97:276-278.

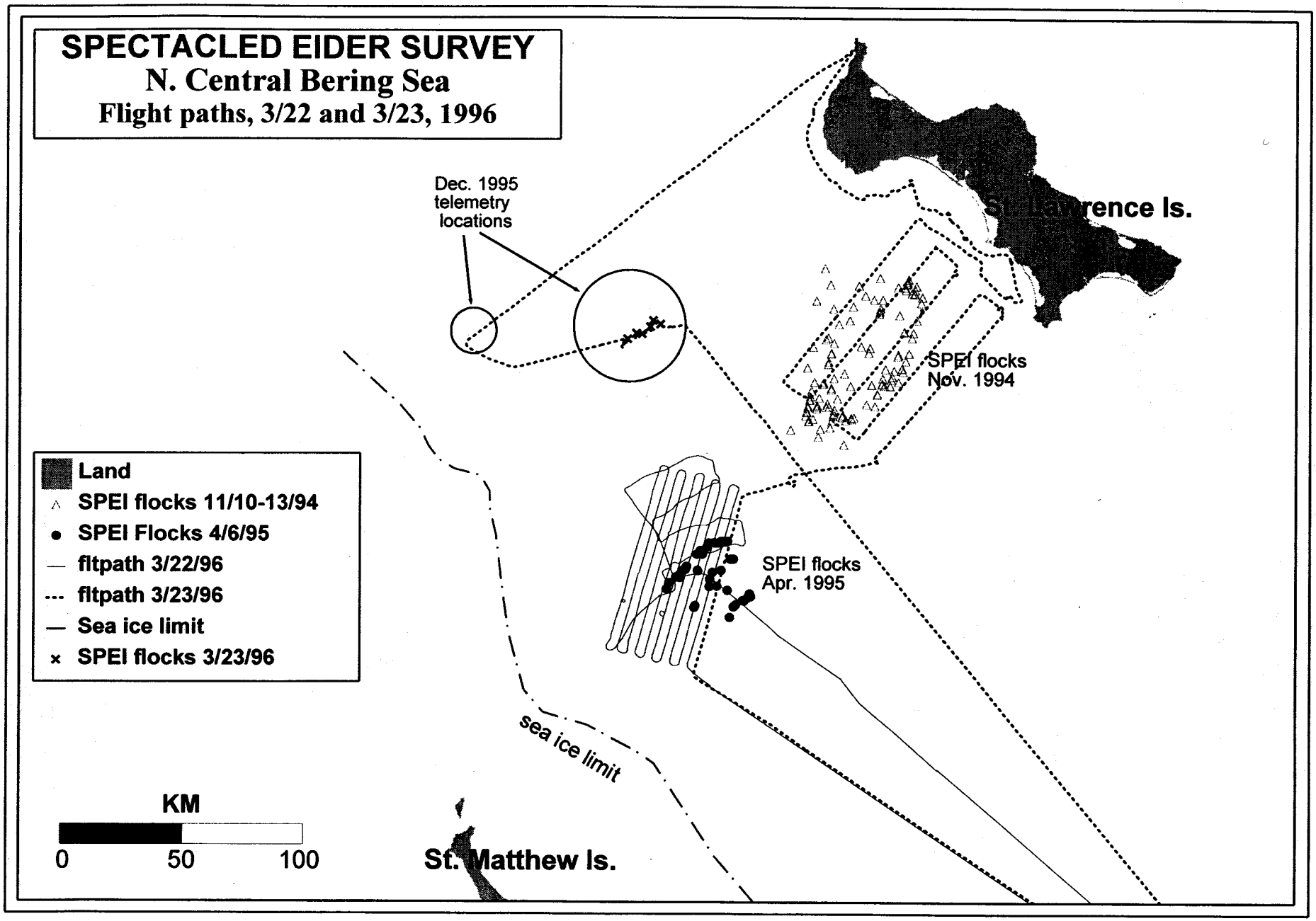

Figure 1. Recorded flight paths from aerial survey reconnaissance flights conducted in the Bering Sea, 22 and 23 March 1996, showing locations of satellite telemetry data and spectacled eider flocks from these and previous surveys.